

THREE SPECIES OF DAGGER NEMATODES PATHOGENIC TO CITRUS

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INTRODUCTION: Dagger nematodes, *Xiphinema* spp., are ectoparasitic nematodes which remain outside the roots and only penetrate root cells with their stylets. Worldwide, at least 14 species of *Xiphinema* have been associated with citrus (2). Pathogenicity to citrus has been confirmed for three species of dagger nematodes, *X. basiri* Siddiqi, *X. brevicolle* Lordello and da Costa, and *X. index* Thorne and Allen (12).

In addition to the direct pathogenic effects that dagger nematodes have on their hosts, this group is widely recognized as important vectors of plant viruses. *Xiphinema index* was the first phytonematode shown to transmit a plant virus and is now recognized as an important vector of grape fanleaf virus in many regions of the world (9, 16). *Xiphinema basiri* is known to transmit cowpea mosaic virus to *Vigna unguiculata* (L.) Walp. subsp. *cylindrica* (L.) Van Eselt. ex Verdc. (catjang) (3). Other species of *Xiphinema* are known to vector viruses such as arabis mosaic, cherry leaf roll, strawberry latent ringspot, tomato ringspot, brome mosaic, and carnation ringspot (18). *Xiphinema* species are not known to transmit any citrus viruses.

SYMPTOMS AND PATHOGENICITY: Under controlled conditions in Israel, Cohn and Orion investigated the symptoms and pathogenicity of two species of dagger nematodes on sour orange, *Citrus aurantium* L. Eight-week-old seedlings were inoculated with 200 specimens of *X. brevicolle* or 360 specimens of *X. index*. Six months after inoculation, the plants were chlorotic and stunted. The nematodes reduced plant growth 46 and 44% respectively, compared to weights of noninoculated control plants (5). They caused a thinning and distinct darkening of the root systems of sour orange and at some sites, a breakdown of the cortex. Feeding occurred at several sites along the roots, but only rarely at the root tips (4). A few young roots had slightly swollen and curved tips. On grape and many other hosts, *X. index* frequently causes swollen or galled roots with multinucleate cells containing dense cytoplasm. On sour orange, this is not a typical diagnostic characteristic, since only a few young roots had slightly swollen and curved tips (8).

In Sudan, *X. basiri* caused swollen and stubby roots, and severely reduced total root size of citrus. In the field, high populations of this nematode were associated with grapefruit, *Citrus X paradisi* Macf., which showed decline symptoms and stubby roots (19).

HOSTS: Dagger nematodes are associated with a wide variety of plants, but woody plants appear to be preferred hosts.

X. basiri is associated with the following plants: *Achras zapota* L. (sapodilla), *Anona squamosa* L. (sugar apple), *Carica papaya* L. (papaya), *Cicer arietinum* L. (chickpea), *Citrus aurantium* (sour orange), *C. limonia* Osbeck (Rangpur lime), *C. X paradisi* (grapefruit), *C. reticulata* Blanco (mandarin), *C. sinensis* (L.) Osbeck (sweet orange), *Cocos nucifera* L. (coconut palm), *Eriobotrya japonica* Lindl. (loquat), *Ficus carica* L. (fig), *Gossypium* sp. (cotton), *Hibiscus esculentum* L. (okra), *Litchi chinensis* Sonn. (litchi), *Lycopersicon esculentum* Mill. (tomato), *Mangifera indica* L. (mango), *Morus alba* L. (white mulberry), *M. rubra* L. (red mulberry), *Musa paradisiaca* L. (plantain), *Pennisetum purpureum* L. (Napier grass), *Phyllanthus emblica* L. (gooseberry tree), *Prunus persica* Batsch (peach), *Psidium guajava* L. (guava), *Punica granatum* L. (pomegranate), *Pyrus communis* L. (pear), *Rosa indica* L. (rose), *Saccharum officinarum* L. (sugarcane), *Solanum melongena* L. (eggplant), *Vitis vinifera* L. (grape), *Zingiber officinale* Roscoe (common ginger), *Zizyphus jujuba* Mill. (jujube) (15).

X. brevicolle was first associated with *Coffea arabica* L. (coffee) in Brazil (13). In Spain, *X. brevicolle* was first reported on *Citrus* sp. but was also associated with 32 other species of cultivated and wild hosts (1). Some common hosts of *X. brevicolle* are *Vitis vinifera* (grape), *Saccharum officinarum* (sugarcane), *Mangifera indica* (mango), and *Litchi chinensis* (litchi).

X. index has frequently been associated with problems on *Vitis vinifera* (grape). Other important hosts or plants with which *X. index* has been associated are: *Cydonia oblonga* Mill. (quince), *Fagus sylvatica* L. (beech), *Ficus carica* (fig), *Fragaria X ananassa* Duchesne (strawberry), *Juglans regia* L. (English walnut), *Malus sylvestris* Mill. (apple), *Morus alba* (white mulberry), *Opuntia* sp. (prickly pear), *Parthenocissus tricuspidata* Planch. (Boston ivy), *Pinus halepensis* Mill. (Aleppo pine), *Pistacea vera* L. (pistachio), *Prunus armeniaca* L. (apricot), *P. avium* L. (sweet cherry), *P. domestica* L. (plum), *P. persica* (peach), and *Pyrus communis* (pear) (1, 16).

DISTRIBUTION:

X. basiri has been reported on *Citrus* sp. and *Sabal palmetto* Lodd. in Indian River County, Florida (7). It is also known to occur in Ceylon, India, Mexico, Nigeria, Puerto Rico, Sudan, and Zimbabwe (6).

X. brevicolle is not known to occur in Florida, but has been reported in California (17). It also has been reported in Brazil, Bulgaria, Chile, Czechoslovakia, France Guadeloupe, Hungary, Israel, Poland, South Africa, and Spain (1, 10, 11).

X. index is not presently known to occur in Florida, but occurs in California and Kansas (14, 17). It also occurs in Algeria, Australia, Argentina, Chile, France, Greece, Hungary, Iran, Iraq, Israel, Italy, North Africa, Poland, Portugal, Spain, South Africa, Turkey, the U.S.S.R., and West Germany (5, 16).

SURVEY AND DETECTION: Species of dagger nematodes are ectoparasites; therefore, to detect their presence it is necessary to submit the soil surrounding roots for laboratory analysis. Indicator symptoms may be stunting, chlorosis, and poorly developed root systems. In some cases, roots may be necrotic and the root tips may be swollen.

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